MACRO SENSORS™
Division Of Howard A. Schaevitz Technologies, Inc.

USER MANUAL

DMI-D1 Series
DC LVDT Indicator

- **1/8 DIN Case**
- **3-button Front Panel Operation**
- **5-digit, 7-segment 0.56" (14.2 mm) LED Display**

The easiest solution to single input LVDT display and control applications

Introduction

The DMI-D1 Series is a DC LVDT (Linear Variable Differential Transformer) indicator that delivers precise measurement and indication for applications using a single DC LVDT input.

The 5-digit, 7-segment LED display provides configuration setup prompts for DC LVDT parameters using intuitive, easy to follow text menus.

Setup

- Select 50 or 60 Hz supply frequency.
- Select decimal point position setting with resolution to 0.0001 of any engineering unit.

Calibration

- **Input Signal Calibration**: Perform 2-point zero and span input signal calibration setting.
- **Analog Output Signal Calibration**: Calibrate analog output milliamp or voltage output low and high settings.

Analog Output Scaling

Set the analog output low (zero) and high (full scale) range settings.

Setpoints

Four independent setpoints with individually configured setpoint actuation values, preprogrammed for above or below activation:

- Lo 1, Lo 2 activates below value.
- hi 1, hi 2 activates above value.

Options

- **Relays:** Up to four 5 amp relays.
- **Analog Output**

  Standard: Fully scalable from 0/4 to 20 mA (or reverse).

  Options: Single 0 to 10 V DC (or reverse).
- **Display Zero**

  Preprogrammed function requires customer supplied switch to operate.
- **Reset Display Value**

  Preprogrammed function requires customer supplied switch to operate.

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Specifications

General

Digital Display: 7-segment, 0.56" (14.2 mm) LEDs.

Display Color: Red

Display Range: -19999 to 99999.

Display Update Rate: 10 times per second.

Display Dimming: 8 brightness levels. Front panel selectable.

Polarity: Assumed positive. Displays – negative.

Annunciators: 6 red LEDs on front panel.

Overrange Indication: oUEr

Underrange Indication: undEr

Front Panel Controls: PROGRAM, UP and DOWN buttons.

Power Supplies

Standard high voltage AC power supply 115 V AC

Optional low voltage DC power supply 24 V DC

Environmental

Operating Temperature: 0°C to 50°C (32 °F to 122°F).

Storage Temperature: -20 °C to 70°C (-4°F to 158°F).

Relative Humidity: 95% (non-condensing) at 40 °C (104°F).

Mechanical

Case Dimensions: 1/8 DIN, 96x48 mm (3.78" x 1.89").

Case Depth: 137 mm maximum (5.39").

Case Material: 94V-0 UL rated self-extinguishing polycarbonate.

Weight: 11.5 oz (0.79 lbs), 14 oz (0.96 lbs) when packed.

Approvals

CE: As per EN-61000-3/4/6 and EN-61010-1.

LVDT Input

Excitation Voltage: 24 V DC.

Temperature Coefficient: ± 50 ppm/°C of full scale (typ.)

LVDT Input: 1M input impedance.

Analog to Digital: Dual scope 17 bipolar converter.

Output Rate: 10 Hz averaged response output.

Line Frequency Rejection: 50/60 Hz noise rejection.

Relays

Plugs into carrier board from rear:

Four 5 A Form A Relays.

Form A Relay Specifications: 5 A 240 VAC. Isolation 3000 V. UL and CSA listed.

Configuration Menu

The Configuration Menu shown opposite is a flow diagram of the DMI-D1 Series' configuration menus and describes the settings and parameters that can be applied in each menu.

Supply Frequency & Decimal Point

The **supply frequency and decimal point** menu allows you to configure:

- The power supply frequency: 50 or **60** Hz (60 Hz is the factory default setting).
- The position of the decimal point: No decimal point, 0.1, **0.12** (default), 0.123, 0.1234, 0.12345

Calibration

The **DC LVDT input signal calibration** menu allows you to perform a 2-point zero and span calibration of the input signal.

Analog Output Calibration

This menu allows you to calibrate the analog output's milliamp or voltage output to suit your application.

Calibrating the analog output requires setting the milliamp or voltage output low [CAL_LO] and high [CAL_HI] parameters using a multimeter connected to the analog output signal (See Figure 1 for an DMI-D1 Series to multimeter connection diagram). The calibrated low and high outputs can be set anywhere between –0.3 to +21 mA for current or –0.3 V to +10.5 V for voltage.

Once the milliamp or voltage output is calibrated, the analog output range can be easily rescaled (zero and full scale) using the analog output scaling mode without having to recalibrate the milliamp or voltage output. The calibrated low and high milliamp or voltage output signal values follow the new span range.

See **Analog Output Scaling and Calibration Example** for more details

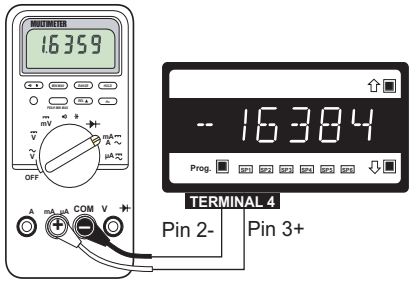
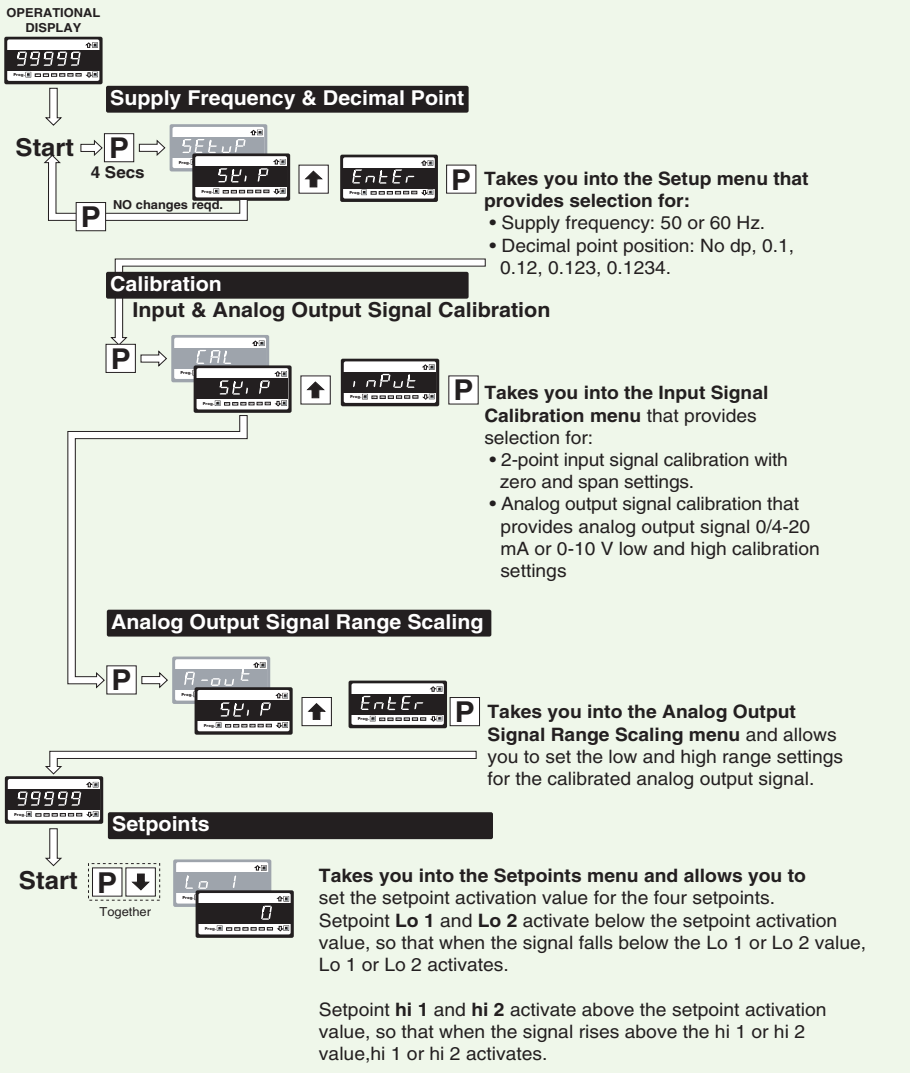


Figure 1 – Multimeter Connections


OPERATIONAL DISPLAY
99999
Supply Frequency & Decimal Point
Start
P
4 Secs
SEtuP
SY, P
EntEr
NO changes reqd.
Takes you into the Setup menu that provides selection for:
• Supply frequency: 50 or 60 Hz.
• Decimal point position: No dp, 0.1, 0.12, 0.123, 0.1234.
Calibration
Input & Analog Output Signal Calibration
CAL
inPut
Takes you into the Input Signal Calibration menu that provides selection for:
• 2-point input signal calibration with zero and span settings.
• Analog output signal calibration that provides analog output signal 0/4-20 mA or 0-10 V low and high calibration settings
Analog Output Signal Range Scaling
A-out
Takes you into the Analog Output Signal Range Scaling menu and allows you to set the low and high range settings for the calibrated analog output signal.
99999
Setpoints
Start
Together
Lo 1
0
Takes you into the Setpoints menu and allows you to set the setpoint activation value for the four setpoints. Setpoint Lo 1 and Lo 2 activate below the setpoint activation value, so that when the signal falls below the Lo 1 or Lo 2 value, Lo 1 or Lo 2 activates.
Setpoint hi 1 and hi 2 activate above the setpoint activation value, so that when the signal rises above the hi 1 or hi 2 value,hi 1 or hi 2 activates.

Analog Output Scaling

The analog output module is a standard single channel, programmable, isolated, 16-bit analog output that can be scaled to any desired span between –199999 to 999999 display counts using the **analog output scaling** menu.

Optional dual channel 0-10 V DC analog output module is also available.

Display Zero and Reset Display Value

DMI-D1 Series has been programmed with a **display zero** and **reset display value** function. The **display zero** function is used to zero the display when the sensor is in any position.

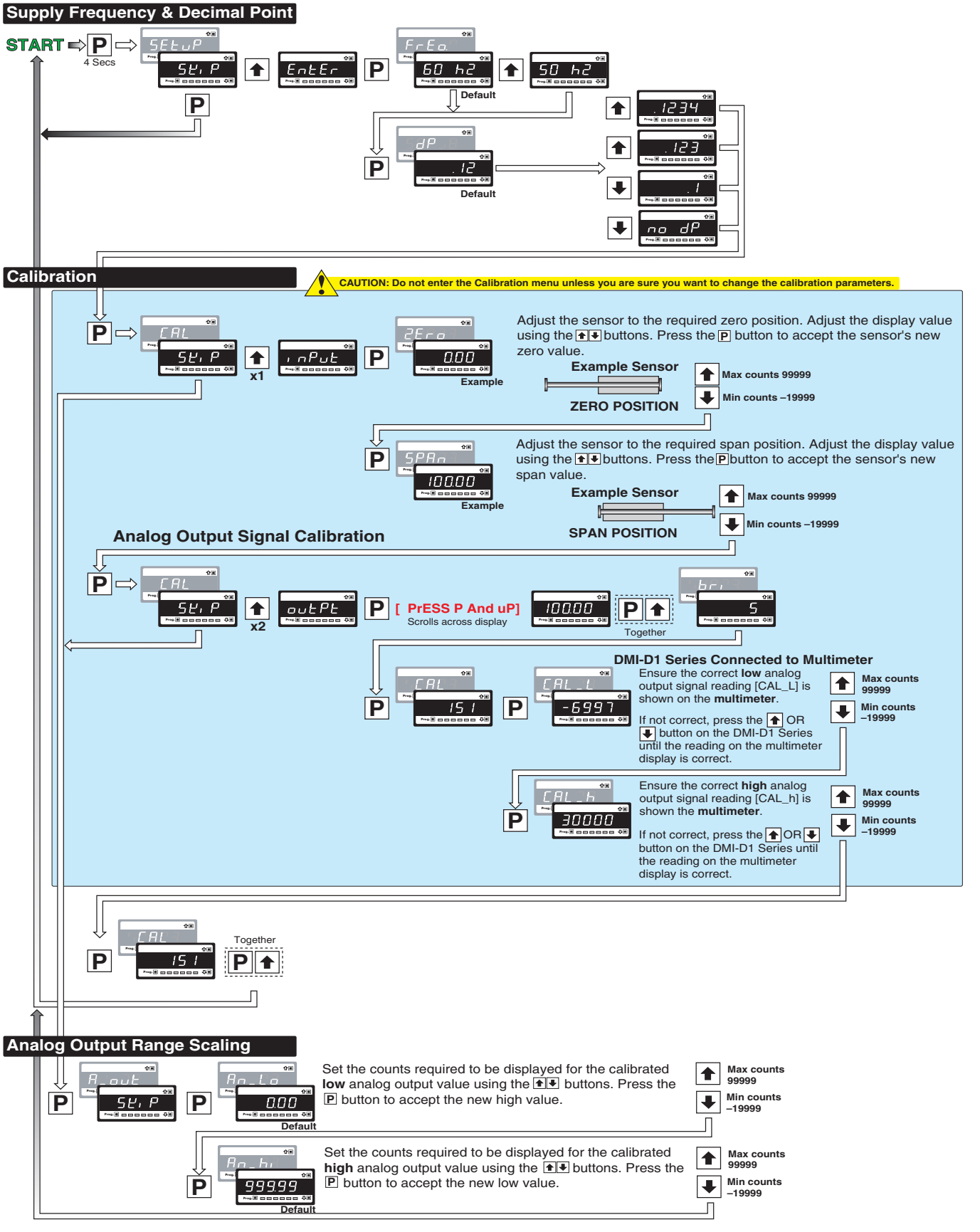
Display zero is initiated from a remote switch (not supplied) connected across the **common** and **hold** pins at the rear of the controller (Terminal 2: Pin 4 Common, Pin 2 Hold).

The **reset display value** function is used to restore the true calibrated value on the display.

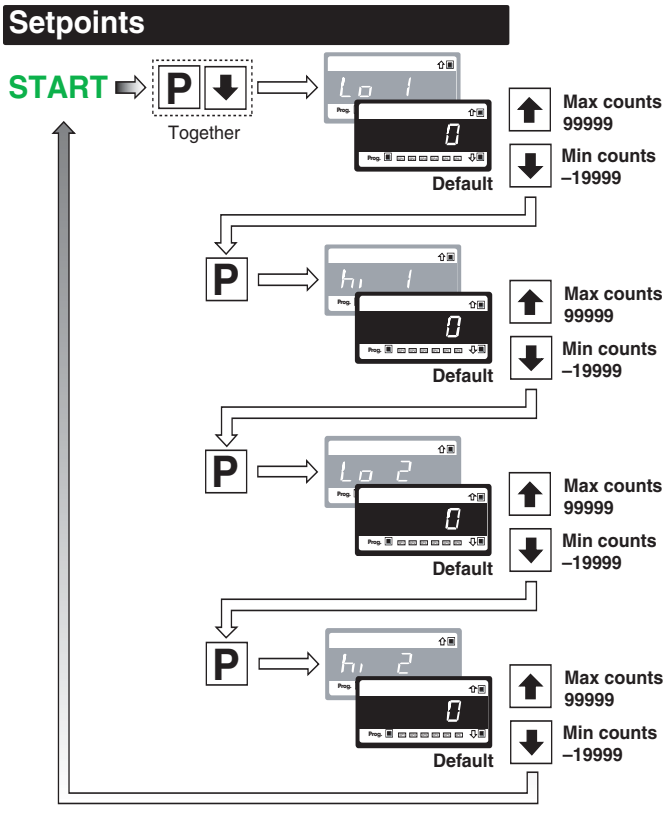
Reset display value is initiated from a remote switch (not supplied) connected across the **common** and **lock** pins at the rear of the controller (Terminal 2: Pin 4 Common, Pin 1 Lock).

The display zero value and reset display value are not retained during a power outage. The display zero and reset display value functions are often used for cut, measure, and trim applications.

Setup Configuration Menu



Setpoints



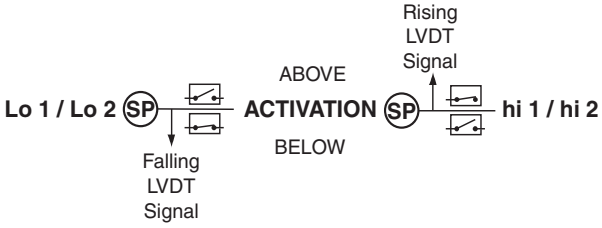
Setpoint Activation

The four setpoints are grouped together in two pairs:

- Setpoint Lo 1 (SP1) and hi 1 (SP2).
- Setpoint Lo 2 (SP3) and hi 2 (SP4).

Low setpoints Lo 1 and Lo 2 are programmed to activate on a **falling signal below** the setpoint activation setting.

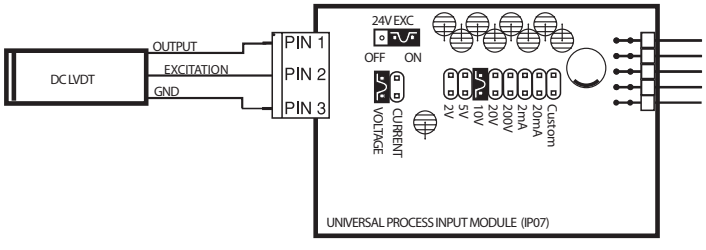
High setpoints hi 1 and hi 2 are programmed to activate on a **rising signal above** the setpoint activation setting.



Input Signal Connection

Technical Description

See Figure 2. The process input module is designed to drive and condition the signal from a DC LVDT transducer. The process input module also provides the 24V DC excitation to the DC LVDT.



DC LVDT Input Connection to DMI-D1 Series

Analog Output Scaling and Calibration Example

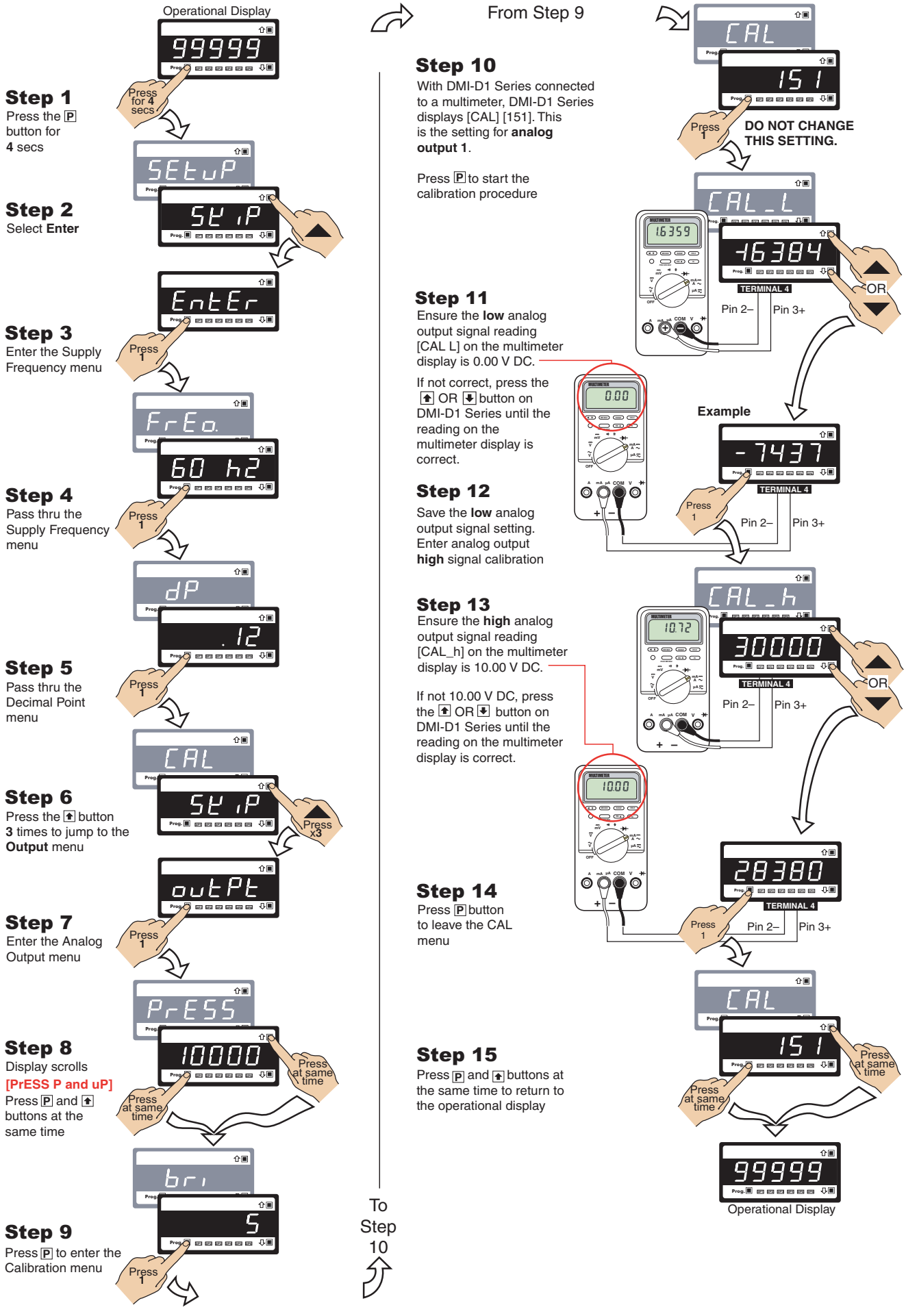
Analog Output Calibration Mode Procedure

In this example the analog output signal is scaled over a range of 50 to 3000 counts. The analog output is then calibrated for a 0 to 10 V DC output.

Note:
*In **Steps 11** to **19,** the analog output may be calibrated to other ranges such as 0-20 mA or 4-20 mA. For current output the header on the analog output module has to be moved to the CURRENT position.*

See the drawing on Page 8 on how to change the analog output from voltage (default) to a current output.

1) See Figure 1. Connect a multimeter to the analog output connector at the rear of the meter (Terminal 4: Pin 3 positive, Pin 2 negative).
2) Make sure the multimeter is set to read the appropriate signal type: volts or milliamps.
3) Carry out the analog output scaling procedure to set zero and full scale settings.
4) If required, carry out the analog output calibration procedure to calibrate the millamp (or voltage) output low and high settings.

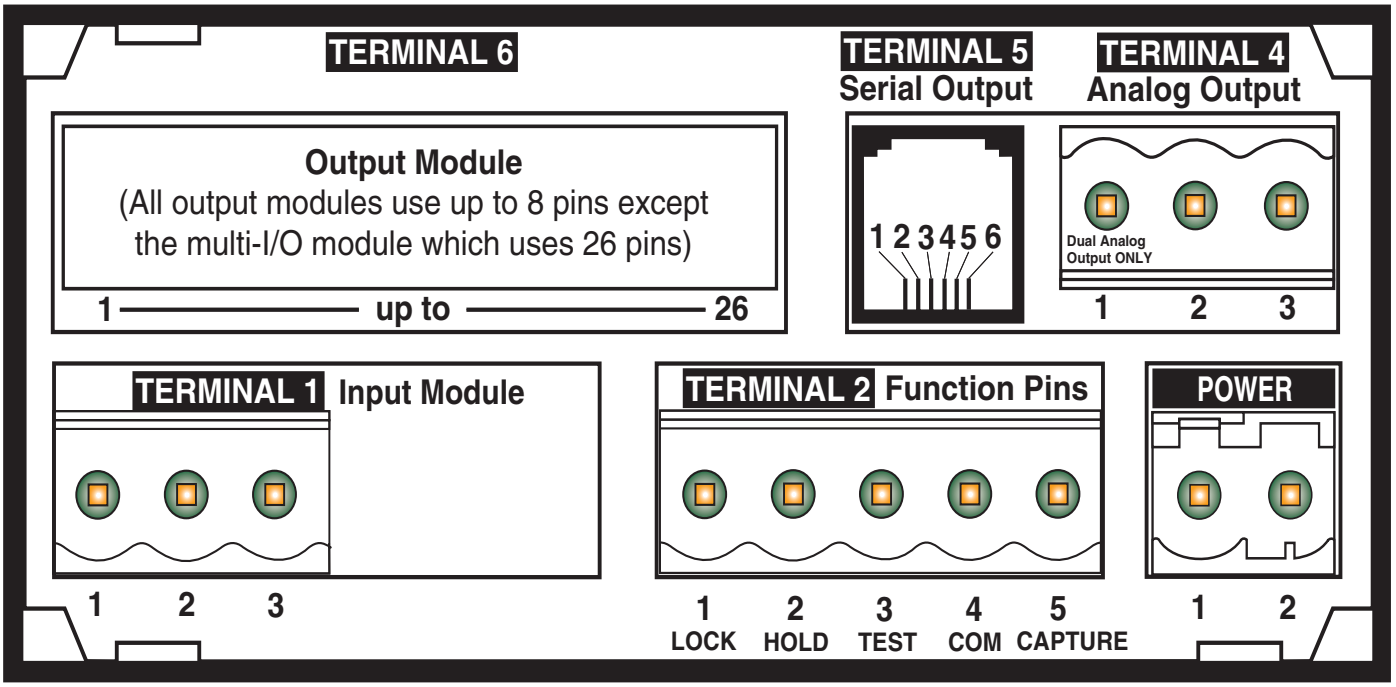

Operational Display
99999
Press for 4 secs
Step 1
Press the P button for 4 secs
SEtuP
Step 2
Select Enter
SU iP
EntEr
Step 3
Enter the Supply Frequency menu
Press 1
FrEq.
60 h2
Step 4
Pass thru the Supply Frequency menu
Press 1
dP
.12
Step 5
Pass thru the Decimal Point menu
Press 1
CAL
SU iP
Step 6
Press the ↑ button 3 times to jump to the Output menu
Press x3
outPt
Step 7
Enter the Analog Output menu
Press 1
PrESS
10000
Step 8
Display scrolls [PrESS P and uP]
Press P and ↑ buttons at the same time
Press at same time
bri
5
Step 9
Press P to enter the Calibration menu
Press 1
To Step 10
From Step 9
Step 10
With DMI-D1 Series connected to a multimeter, DMI-D1 Series displays [CAL] [151]. This is the setting for analog output 1.
Press P to start the calibration procedure
CAL
151
Press 1
DO NOT CHANGE THIS SETTING.
CAL_L
16359
16384
TERMINAL 4
Pin 2–
Pin 3+
OR
Step 11
Ensure the low analog output signal reading [CAL L] on the multimeter display is 0.00 V DC.
If not correct, press the ↑ OR ↓ button on DMI-D1 Series until the reading on the multimeter display is correct.
0.00
Example
-7437
Step 12
Save the low analog output signal setting. Enter analog output high signal calibration
Press 1
CAL_h
10.72
30000
Step 13
Ensure the high analog output signal reading [CAL_h] on the multimeter display is 10.00 V DC.
If not 10.00 V DC, press the ↑ OR ↓ button on DMI-D1 Series until the reading on the multimeter display is correct.
10.00
28380
Step 14
Press P button to leave the CAL menu
Press 1
CAL
151
Step 15
Press P and ↑ buttons at the same time to return to the operational display
Press at same time
99999
Operational Display

Connector Pinouts

All external connections to DMI-D1 Series is via the following six connector terminal blocks located at the rear of the controller:

- Terminal 1: DC LVDT Input Signals.
- Terminal 2: Function Pins.
- Power: AC / DC Power Supply.
- Terminal 4: Analog Output (optional).
- Terminal 5: Serial Output (optional).
- Terminal 6: Relay Output Module.

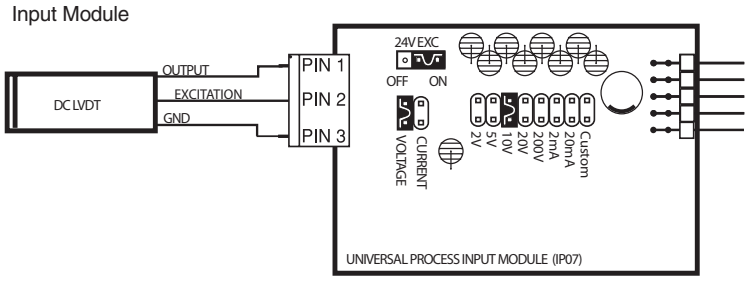
The DMI-D1 Series uses plug-in type screw terminal connectors for most input and output connections, an RJ-11 phone connector for the optional RS-232 or RS-485 serial outputs, and an RJ-45 phone connector for the optional Ethernet output.



Rear Panel Pinout Diagram

WARNING: **AC and DC input signals and power supply voltages can be hazardous. Do not connect live wires to screw terminal plugs, and do not insert, remove, or handle screw terminal plugs with live wires connected.**

Connector	Pin	Name	Description
TERMINAL 4 **Analog Outputs** Pins 1 to 3		TERMINAL 4 connects the analog output module to external devices. A single 0~4 to 20 mA (standard) or (optional) 0 to 10 V DC is supported on the standard, Ethernet, or DeviceNET carrier board.	
	1	-	-
	2	Negative (–)	Negative for Analog Output.
	3	Positive (+)	Positive for Analog Output .

Connector	Pin	Name	Description
TERMINAL 1 **Input Signals** Pins 1 up to 11	1	+ Signal	Input Module 
	2	– Signal	
	3	–Excitation	
	4	+Excitation	
	5	Not Connected	
	6	Not Connected	
	7	Not Connected	
	8	Not Connected	
	9	Not Connected	
	10	Ground	
	11	Shield	
TERMINAL 2 **Function Pins** Pins 1 to 5	1	Reset Display Value (Lock)	By connecting Pin 1 (**lock**) to Pin 4 (**common**) with a remote spring-return switch restores the display to the true calibrated value.
	2	Display Zero (Hold)	By connecting Pin 2 (**hold**) to Pin 4 (**common**) with a remote spring-return switch zeroes the display.
	3	Display Test and Reset	Pin 3 (**display test** and **reset** pin) provides a test of the controller's display and resets the microprocessor when Pin 3 is connected to Pin 4.
	4	Common	To activate the **hold**, **test and reset**, or **lock** pins from the rear of the controller, the respective pins have to be connected to the **common** pin.
	5	-	-
			For further details on the function pins, contact Macro Sensors.
POWER **Auto Sensing AC / DC Power Supply** Pins 1 and 2	1	AC Neutral / DC –	The **power** connector supplies AC / DC power to the controller via a standard high voltage or optional low voltage auto-sensing power supply mounted on the main board. **PS1**: Standard High Voltage option. 115 V AC. **PS2**: Optional Low Voltage option. 24 V DC.
	2	AC Line / DC +	

TERMINAL 5

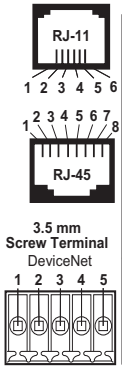
Serial Outputs

Pins 1 up to 8

TERMINAL 5 connects an optional serial output module to external devices.

The **standard** carrier board supports a single or dual RS-232 or RS-485 ASCII or Modbus serial card connected thru an RJ-11 socket.

The **Ethernet** carrier board uses an RJ-45 socket at 10/100 Base-T.



	STANDARD CARRIER BOARD				ETHERNET CARRIER BOARD		DEVICENET CARRIER BOARD
Pin No.	RS-232 (ASCII or Modbus) RJ-11 Socket		RS-485 (ASCII or Modbus) RJ-11 Socket		RJ-45 Socket (10/100 Base-T)		3.5 mm Pitch Screw Terminal
	Single Output	Dual Output	Single Output	Dual Output			
1	Reserved for future use	RXD1	Reserved for future use	B1	White/Orange	TXD+	Negative (−) 24 V
2	Isolated Ground	0 V	Isolated Ground	0 V	Orange	TXD−	Can − (negative)
3	+5 VDC to power external converters	0 V1	+5 VDC to power external converters	0 V1	White/Green	RXD+	N/C
4	TXD. Transmitted Serial	TXD	A (High)	A	Blue		Can + (positive)
5	RXD. Received Serial	RXD	B (Low)	B	White/Blue	−	Positive (+) 24 V
6	Reserved for future use	TXD1	Reserved for future use	A1	Green	RXD−	Not applicable
7	Not applicable	Not applicable	Not applicable	Not applicable	White/Brown	−	Not applicable
8	Not applicable	Not applicable	Not applicable	Not applicable	Brown	−	Not applicable

TERMINAL 6

Relay Outputs

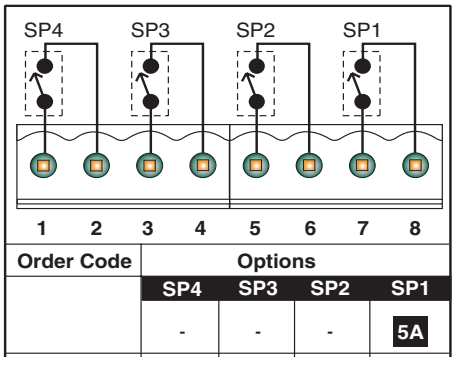
Pins 1 up to 8

TERMINAL 6 connects electromechanical relays to external applications.

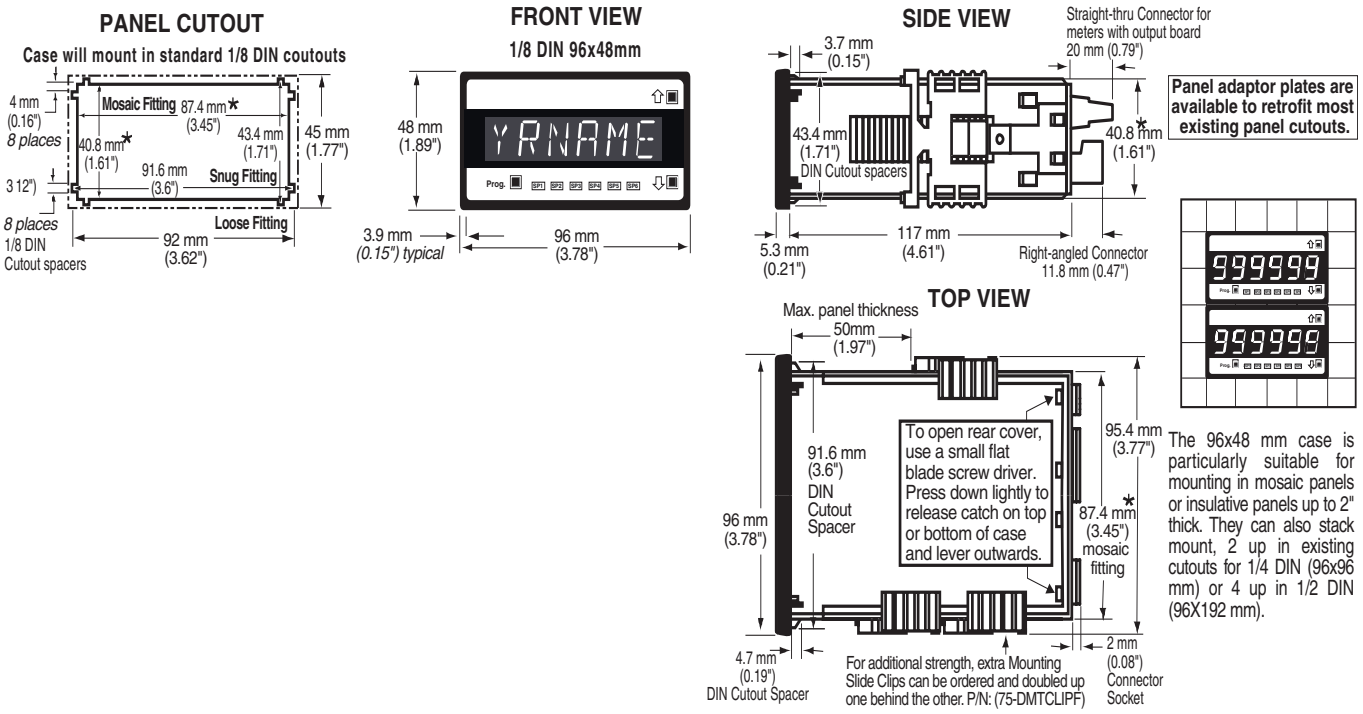
With 4 relays installed, an 8-pin connector block is used.

1	Normally Open SP4
2	Common SP4
3	Normally Open SP3
4	Common SP3
5	Normally Open SP2
6	Common SP2
7	Normally Open SP1
8	Common SP1

Relay Modules with Four 5 A Form A Relays



Order Code	Options			
	SP4	SP3	SP2	SP1
	-	-	-	5A


PANEL CUTOUT
Case will mount in standard 1/8 DIN coutouts
4 mm (0.16") 8 places
Mosaic Fitting
87.4 mm* (3.45")
40.8 mm* (1.61")
43.4 mm (1.71")
91.6 mm (3.6")
Snug Fitting
45 mm (1.77")
3 12")
8 places 1/8 DIN Cutout spacers
Loose Fitting
92 mm (3.62")
FRONT VIEW
1/8 DIN 96x48mm
48 mm (1.89")
3.9 mm (0.15") typical
96 mm (3.78")
SIDE VIEW
Straight-thru Connector for meters with output board 20 mm (0.79")
3.7 mm (0.15")
43.4 mm (1.71") DIN Cutout spacers
40.8 mm* (1.61")
Panel adaptor plates are available to retrofit most existing panel cutouts.
5.3 mm (0.21")
117 mm (4.61")
Right-angled Connector 11.8 mm (0.47")
TOP VIEW
Max. panel thickness 50mm (1.97")
To open rear cover, use a small flat blade screw driver. Press down lightly to release catch on top or bottom of case and lever outwards.
91.6 mm (3.6") DIN Cutout Spacer
96 mm (3.78")
95.4 mm (3.77")
87.4 mm* (3.45") mosaic fitting
4.7 mm (0.19") DIN Cutout Spacer
For additional strength, extra Mounting Slide Clips can be ordered and doubled up one behind the other. P/N: (75-DMTCLIPF)
2 mm (0.08") Connector Socket
The 96x48 mm case is particularly suitable for mounting in mosaic panels or insulative panels up to 2" thick. They can also stack mount, 2 up in existing cutouts for 1/4 DIN (96x96 mm) or 4 up in 1/2 DIN (96X192 mm).

Installation Procedure

WARNING

AC and DC power supply voltages are hazardous. Make sure the power supply is isolated before connecting to the meter.

STEP A Prepare the Panel

1) Cut a hole in the panel to suit the panel cutout. See panel cutout sizes above.

STEP B Install the Meter

1) Remove both mounting clips from the meter.
2) Push the meter into the panel cutout from the front of the panel. ②
3) Attach both mounting clips to the meter from the rear of the panel and push them towards the front of the panel until the meter is firmly held. ③

STEP C Connect the Cables

① 1) Connect all input and output signal cables to the connector pins. (See *Connector Pinouts* for details).

2) Connect the power cables to the connector pins. (See *Connector Pinouts* for details).

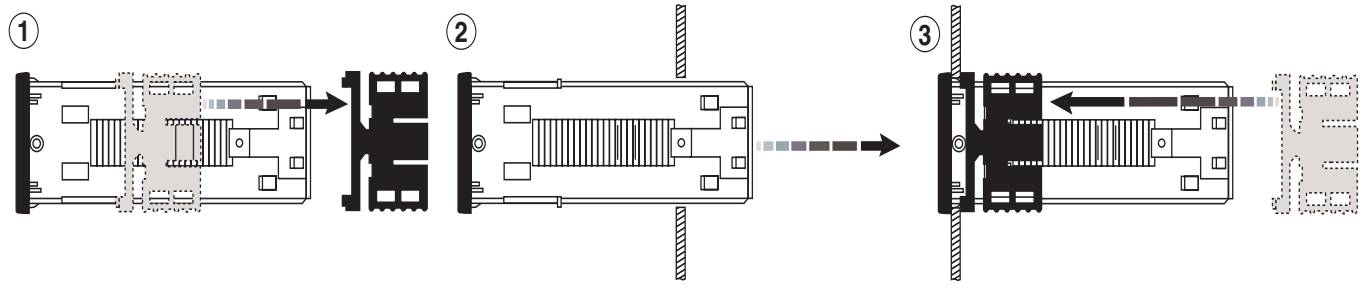


Figure 5 – DMI-D1 Series Installation Sequence

Differential measurements are now available with Macro Sensors' Dual Input LVDT Controller

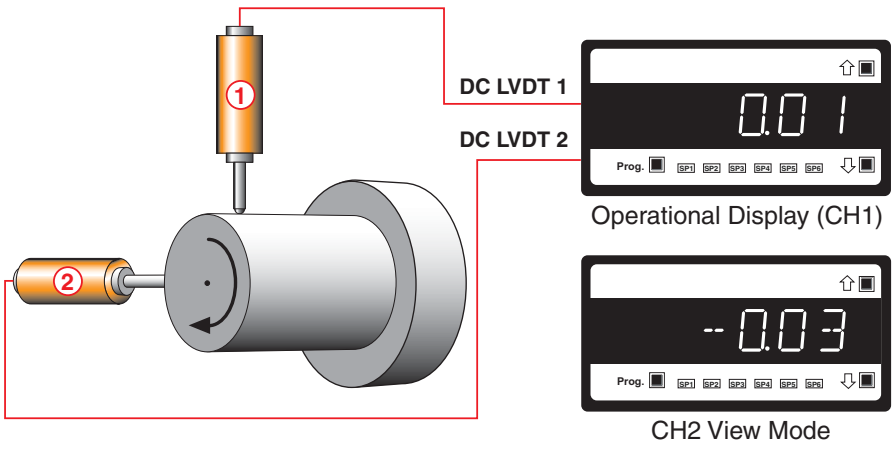
LVDT sensors can be applied in almost all engineering applications covering civil, mechanical, petrochemical, power generation, production, aerospace, defence, and much more.

They can be used on production lines to automatically gauge products for quality control and product sorting.

In the power generation and petrochemical industries they can be used, for example, as servo position feedback on actuated equipment such as valves and dampers, or for measuring turbine casing expansion.

Submersible units can be used in marine and offshore mining applications. Sensors that meet military environmental standards have been applied to defence and aerospace applications.

Following are applications that show the power and versatility of Macro Sensors' DMC-D2 dual input differential measurement controller.

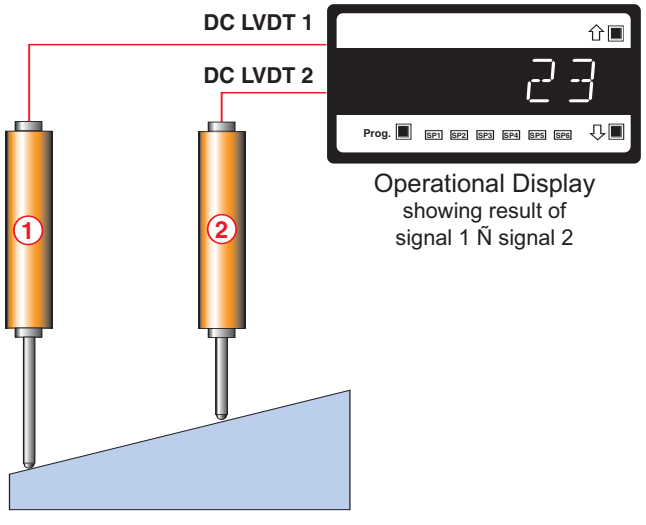


ALIGNMENT TOOL

Measured using two LVDT sensors at 90°

DC LVDT 1 to CH1 = Shown on Display

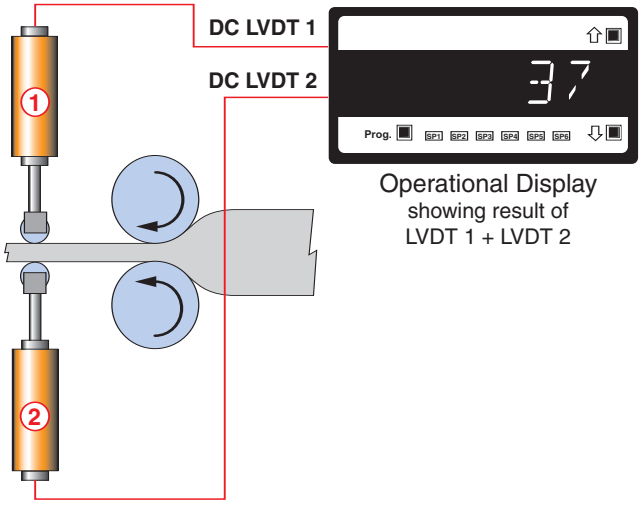
DC LVDT 2 to CH2 = Use View Mode to view CH2



SLOPE INDEXING

Measured using two parallel DC LVDT sensors (1 – 2)

DC LVDT 1 minus DC LVDT 2 = Displayed Result



THICKNESS MONITORING

Measured using two opposed DC LVDT sensors (1 + 2)

DC LVDT 1 plus DC LVDT 2 = Displayed Result

For further information on Macro Sensor's DMC-D2 dual input differential measurement controller contact Macro Sensors and request:

Brochure: ***DMC-D2 Series.***

User Manual: ***DMC-D2 Series.***

Or go to **www.macrosensors.com** and download a pdf of either document from our free downloadable literature.

Notes

Frequency:

CH 1

Decimal Point Position:

Input Signal

ZEro:

SPAn:

Analog Output Signal Calibration

A_OUT1

CAL_L:

CAL_h:

Scale Range

Zero:

Full Scale:

Setpoint Activation Values

Lo 1:

hi 1:

Lo 2:

hi 2:

WARRANTY

Macro Sensors warrants that its products are free from defects in material and workmanship under normal use and service for a period of one year from date of shipment. Macro Sensors' obligations under this warranty are limited to replacement or repair, at its option, at its factory, of any of the products which shall, within the applicable period after shipment, be returned to Macro Sensors' facility, transportation charges pre-paid, and which are, after examination, disclosed to the satisfaction of Macro Sensors to be thus defective. The warranty shall not apply to any equipment which shall have been repaired or altered, except by Macro Sensors, or which shall have been subjected to misuse, negligence, or accident. In no case shall Macro Sensors' liability exceed the original purchase price. The aforementioned provisions do not extend the original warranty period of any product which has been either repaired or replaced by Macro Sensors.

USER'S RESPONSIBILITY

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